

Remote-sensing supported monitoring of global biodiversity change



EarthEnv



Yale

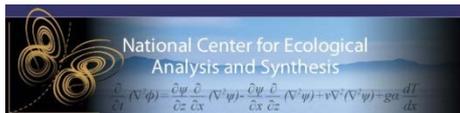
Walter Jetz
EEB, FES
Yale University

Remote-sensing supported global terrestrial biodiversity monitoring

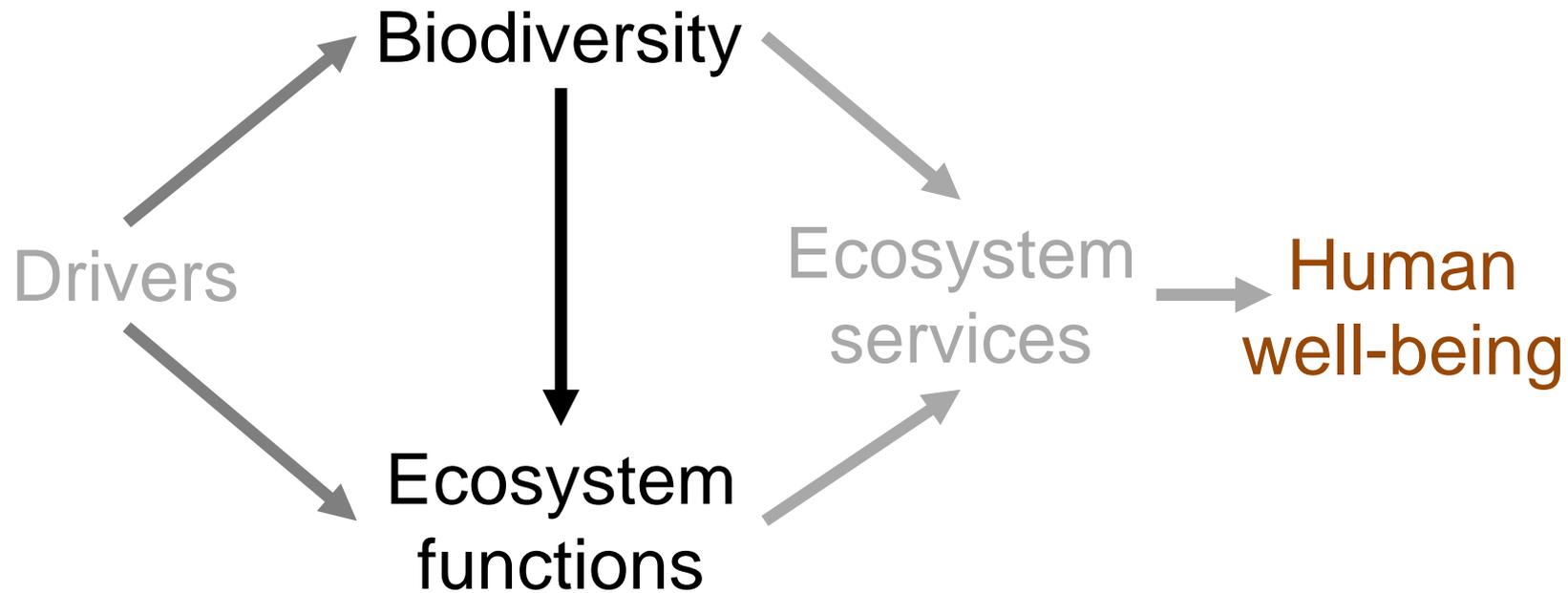
PIs: Walter Jetz (Yale U), Rob Guralnick (CU Boulder), Brian McGill (U Maine), Forrest Melton (NASA Ames, CSUMB)

Postdocs, Students: Dr. Mao-Ning Tuanmu (Yale U, NASA-funded), Dr. Adam Wilson (Yale U, Yale-YCEI-funded), Dr. Benoit Parmentier (NCEAS/ U Maine, Nasa/iPlant-funded), Dr. Giuseppe Amatulli (Yale U, Yale-funded)

Others: Alberto Guzman (CSUMB), Jeremy Malczyk (Yale U), Map of Life Team (Yale, Boulder), Dave Thau (Google)

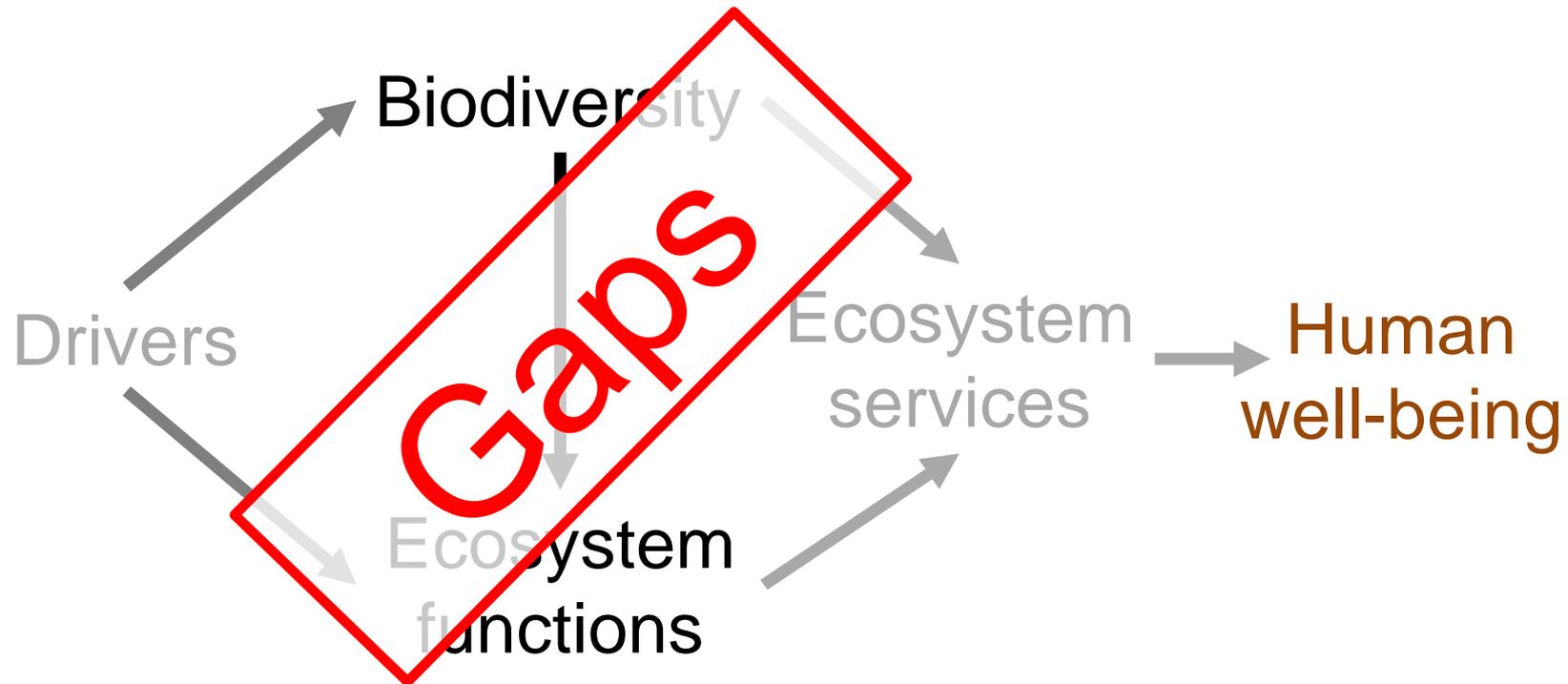


Monitoring the health of our planet



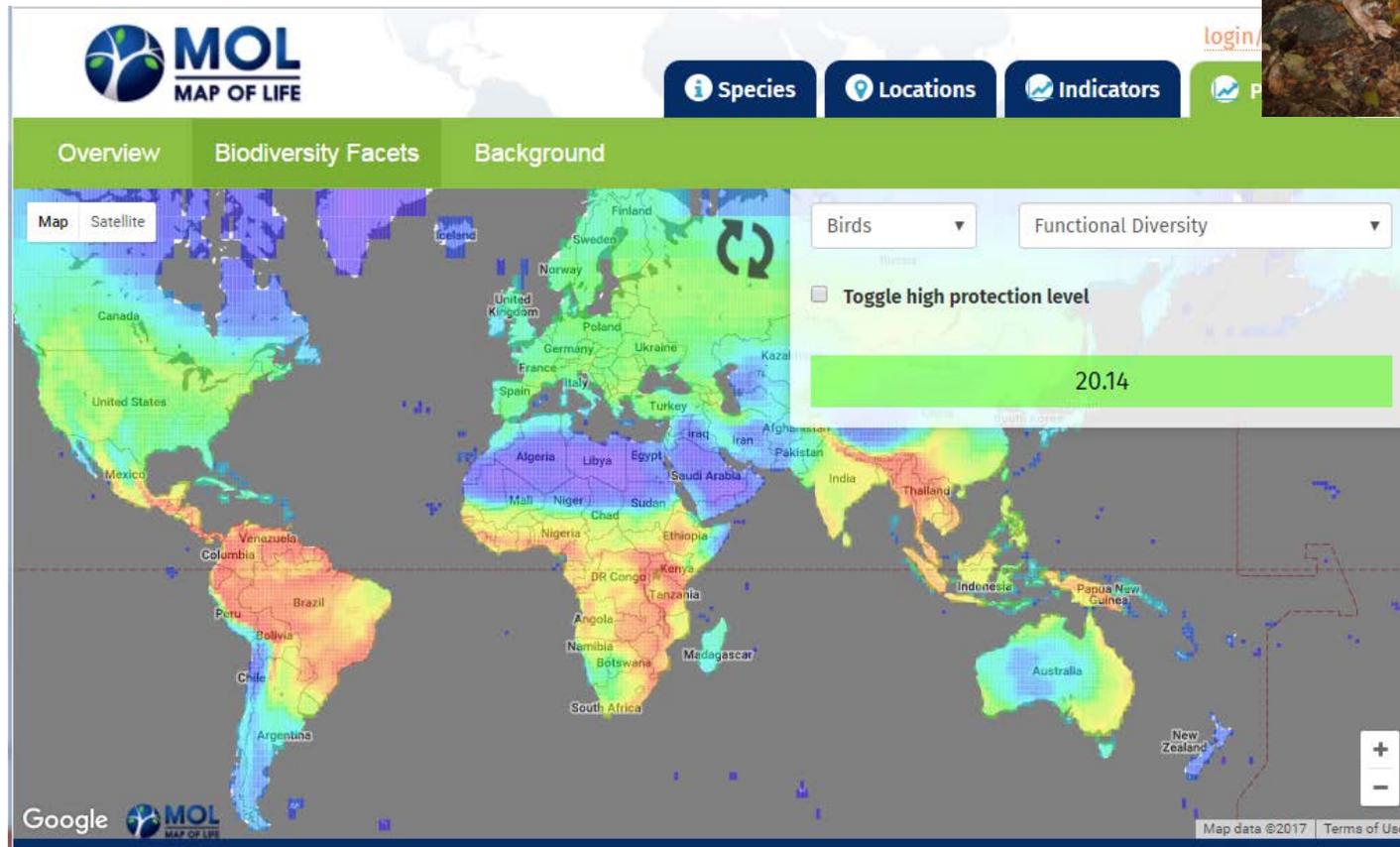
Intergovernmental Platform for
Biodiversity & Ecosystem Services

Monitoring the health of our planet



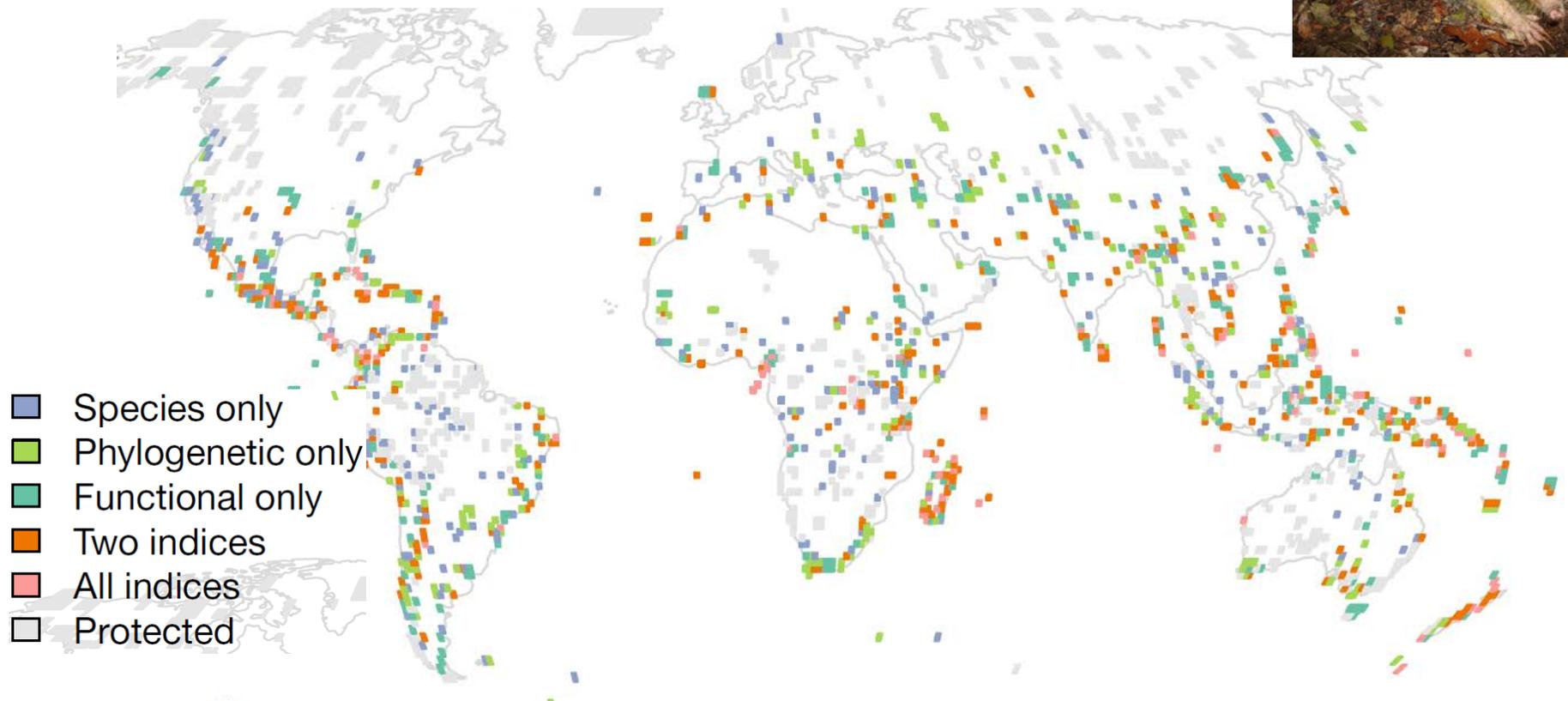
Large conservation gains possible for global biodiversity facets

Laura J. Pollock¹, Wilfried Thuiller¹ & Walter Jetz^{2,3} in press



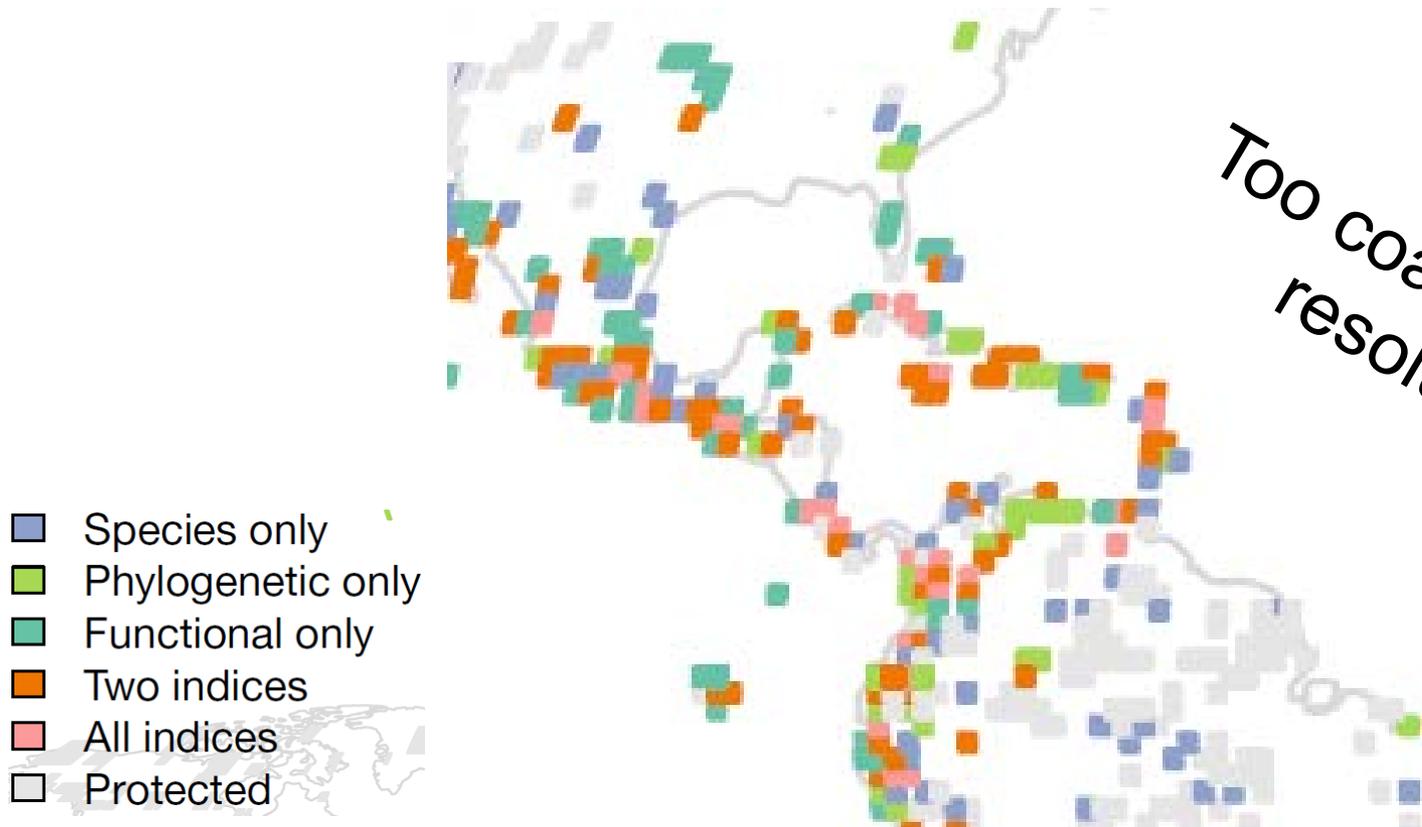
Large conservation gains possible for global biodiversity facets

Laura J. Pollock¹, Wilfried Thuiller¹ & Walter Jetz^{2,3} in press



Large conservation gains possible for global biodiversity facets

Laura J. Pollock¹, Wilfried Thuiller¹ & Walter Jetz^{2,3} in press



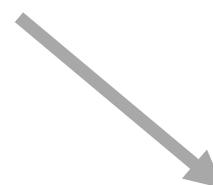
Monitoring the health of our planet



Remote sensing



Biodiversity

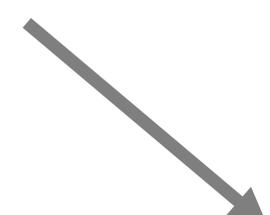
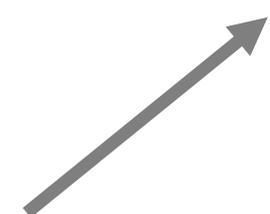


Ecosystem services

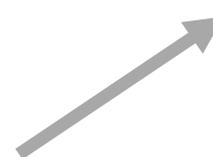


Human well-being

Drivers



Ecosystem functions



Remote sensing

Remote sensing



I. Develop, assess, use global remote sensing layers for biodiversity modeling

EarthEnv



II. Develop informatics tools and infrastructure

GEO BON



III. Begin to support global monitoring

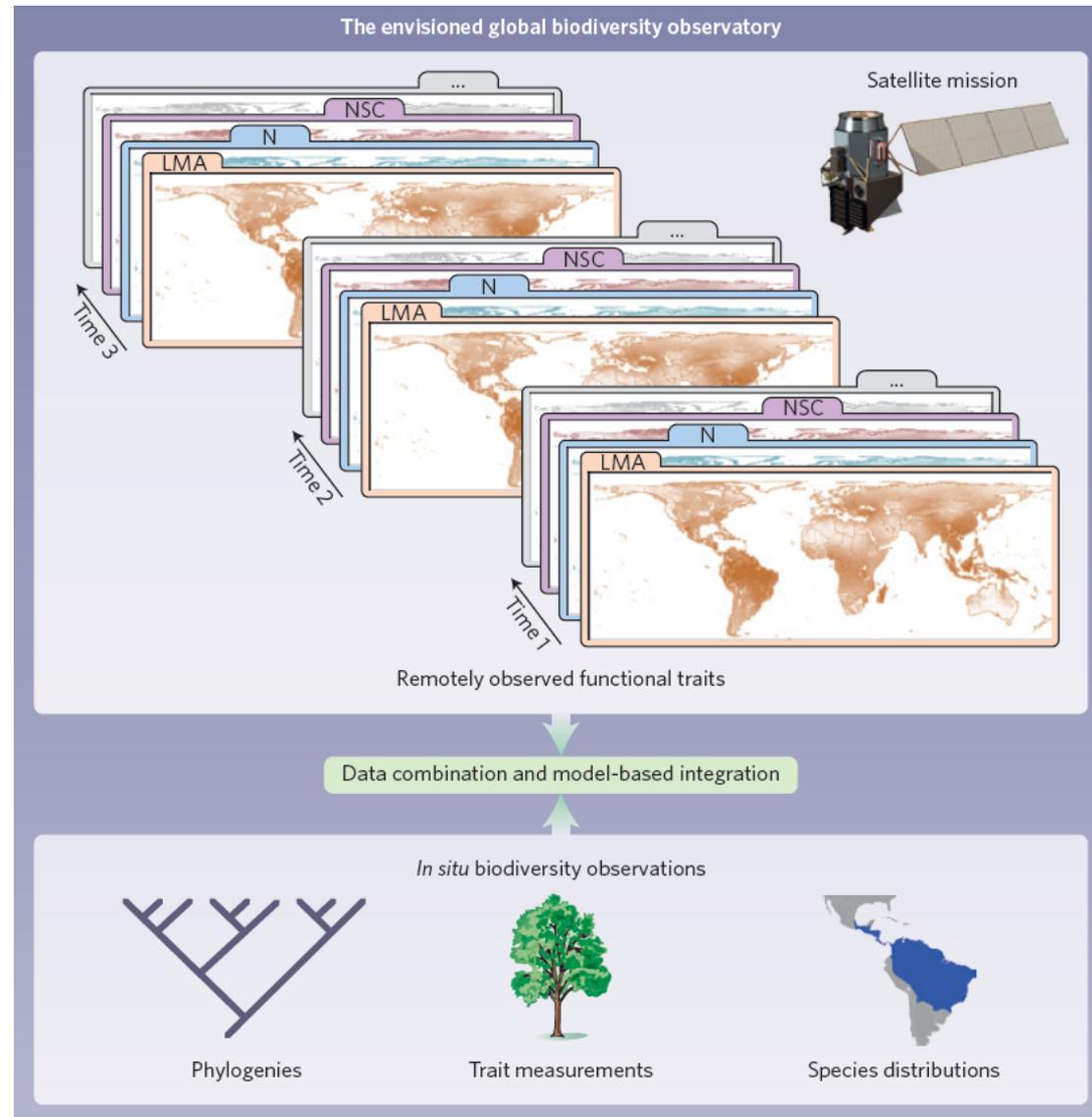


Toward a global imaging spectroscopy mission ...



Jetz, Cavender-Bares et al. (Nature Plants 2016)

Monitoring plant functional diversity from space



Species Distribution EBV



Species Populations Working Group

Jetz et al. (MS)

Indicators

Species protection

Species extinction risk

Driver impacts on function

Invasive species impact

Ecosystem vulnerability, distribution

Species population size

Species status information

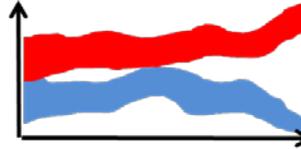
Trends in

Ecosystem condition

Ecosystem services

Species range size

Driver impacts on species



Community function

Driver impacts on ecosystem services

Species populations

Community composition

Species traits

Ecosystem structure

Ecosystem function

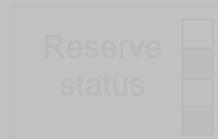
Ancillary Data



Drivers



Reserve status



Species Distribution EBV

In prep



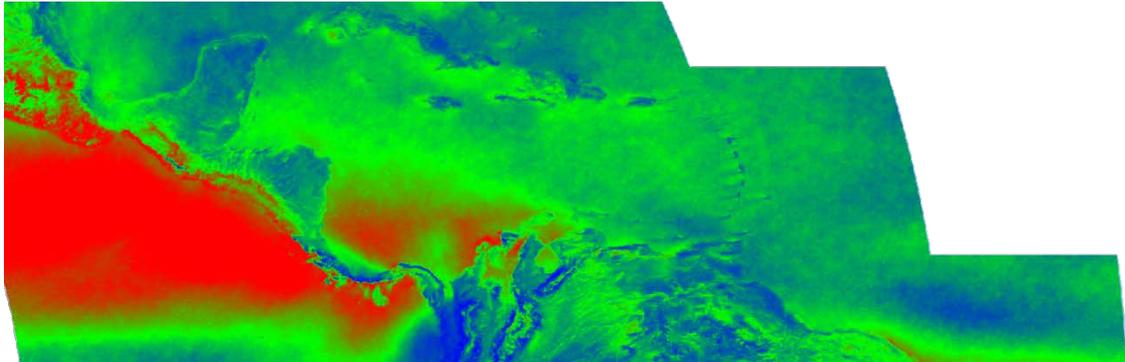
GEO BON

Species Populations Working Group

Daily, 1km cloud cover



Adam Wilson
Yale, U Buffalo



Wilson & Jetz,
PLoS Biology 2016

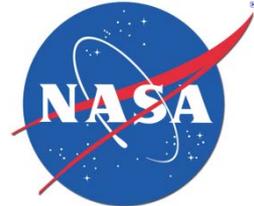
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SCIENCE

A Cloud Atlas Provides Clues to Life on Earth

Trilobites
By JOANNA KLEIN APRIL 4, 2016

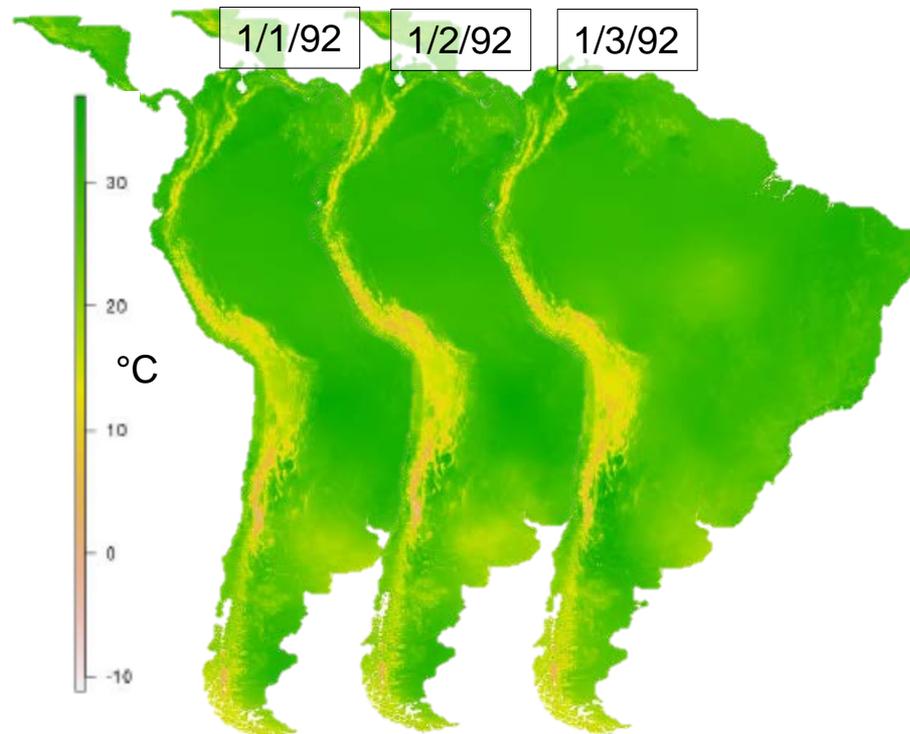
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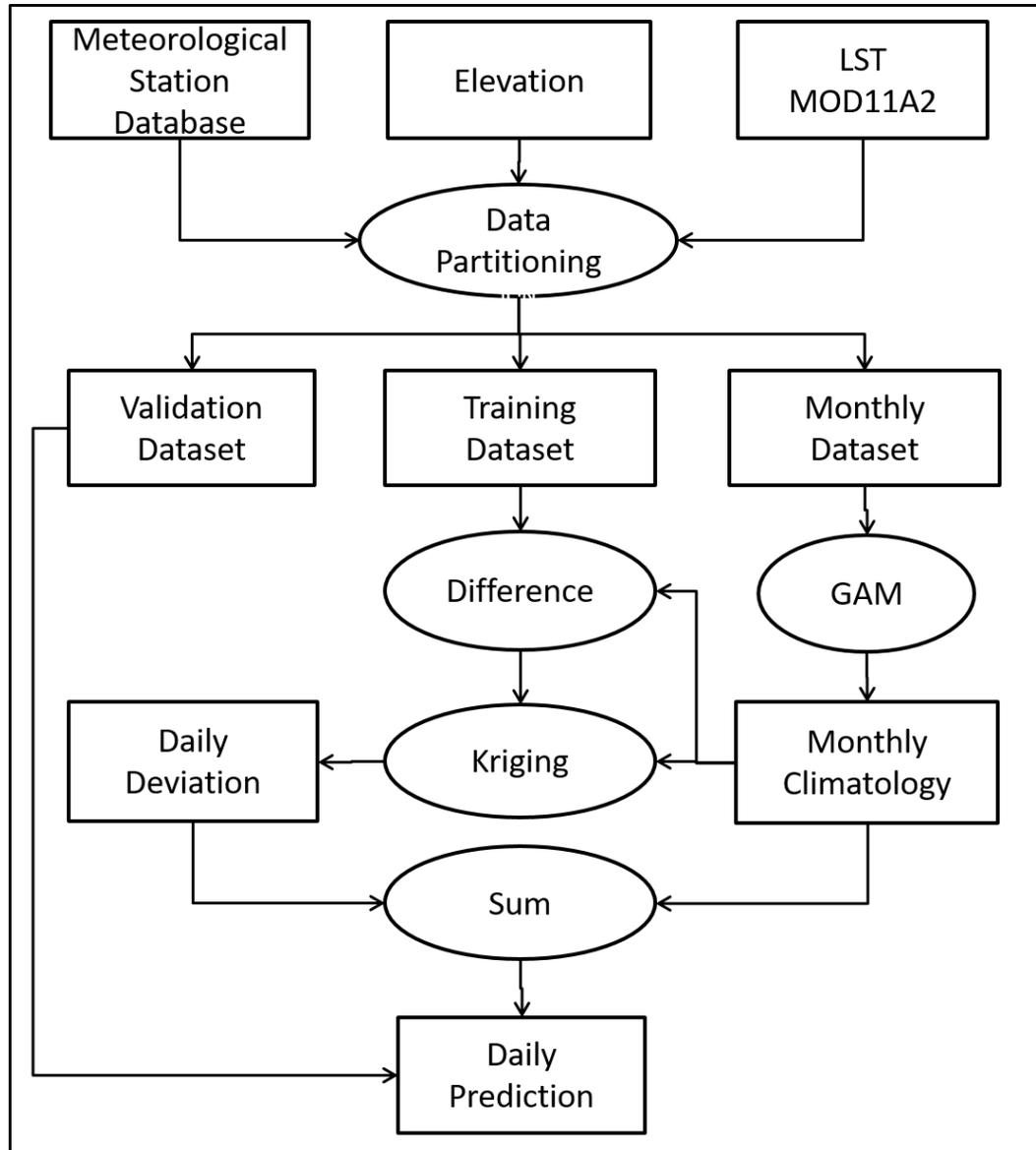
A multi-decadal time series of 1km daily temperature



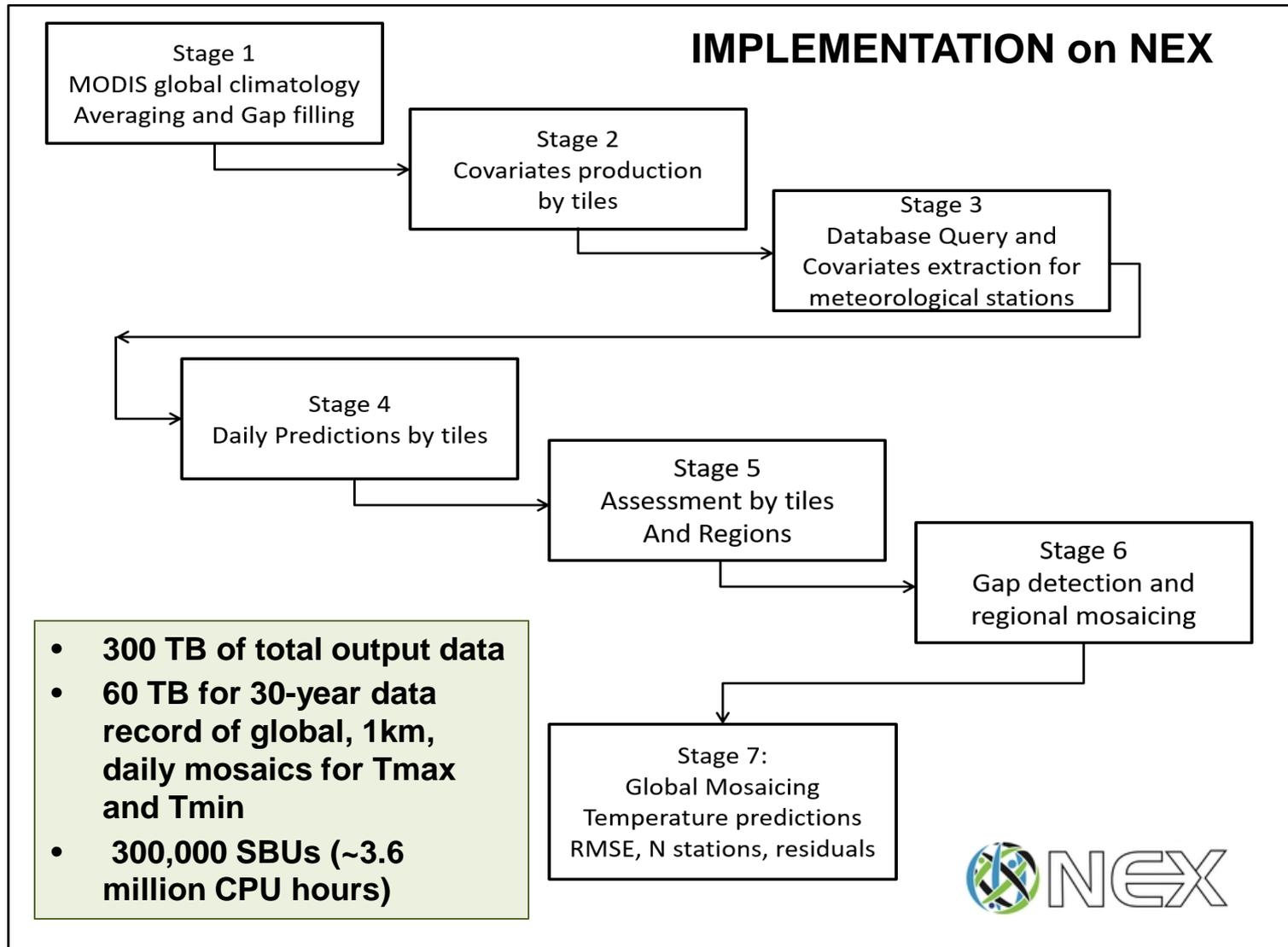
- MODIS cloud mask and LST data + met station data



Daily, 1km temperature

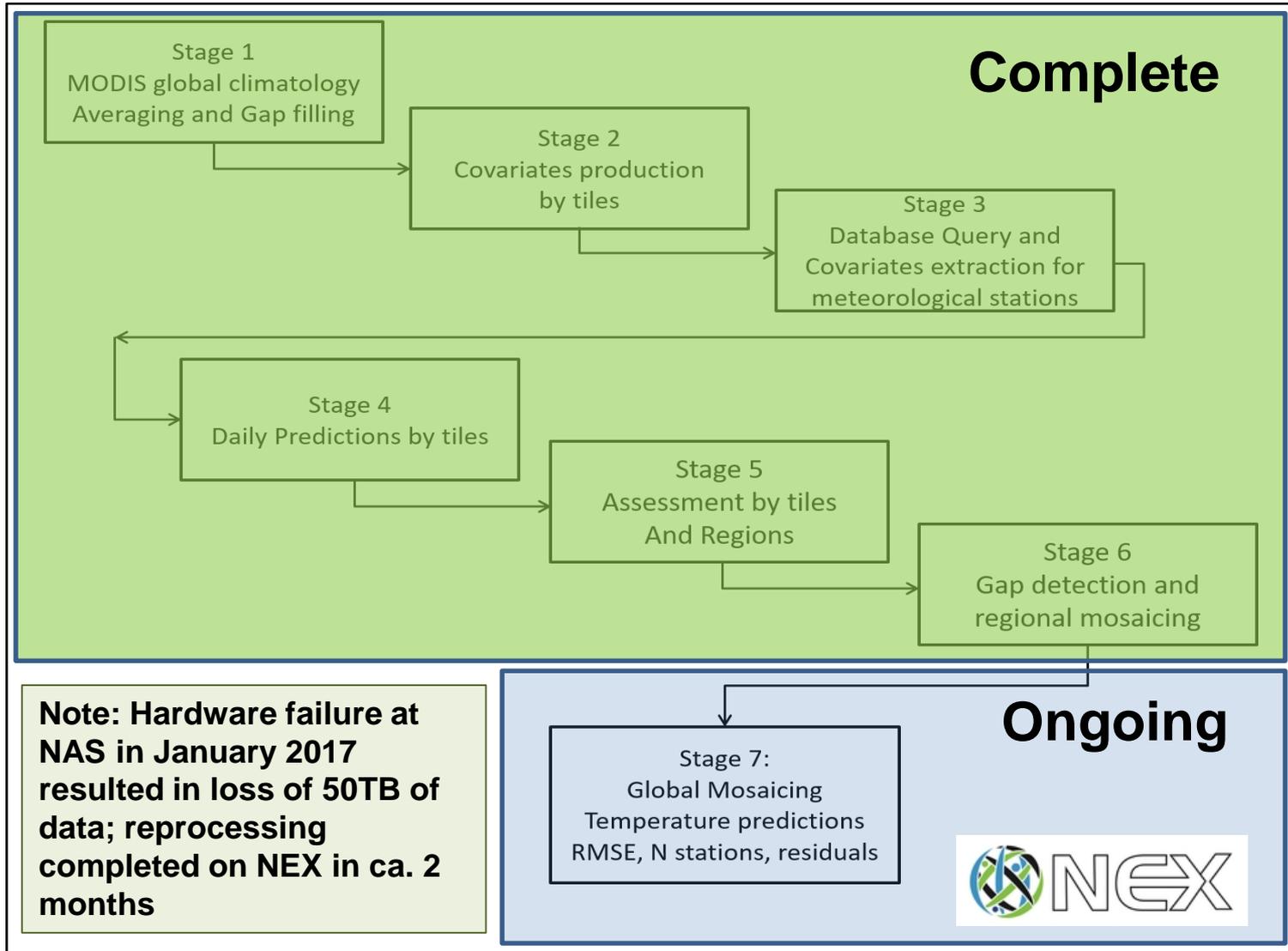


Daily, 1km temperature



Technically, computationally comparable to MEaSURES projects

Daily, 1km temperature

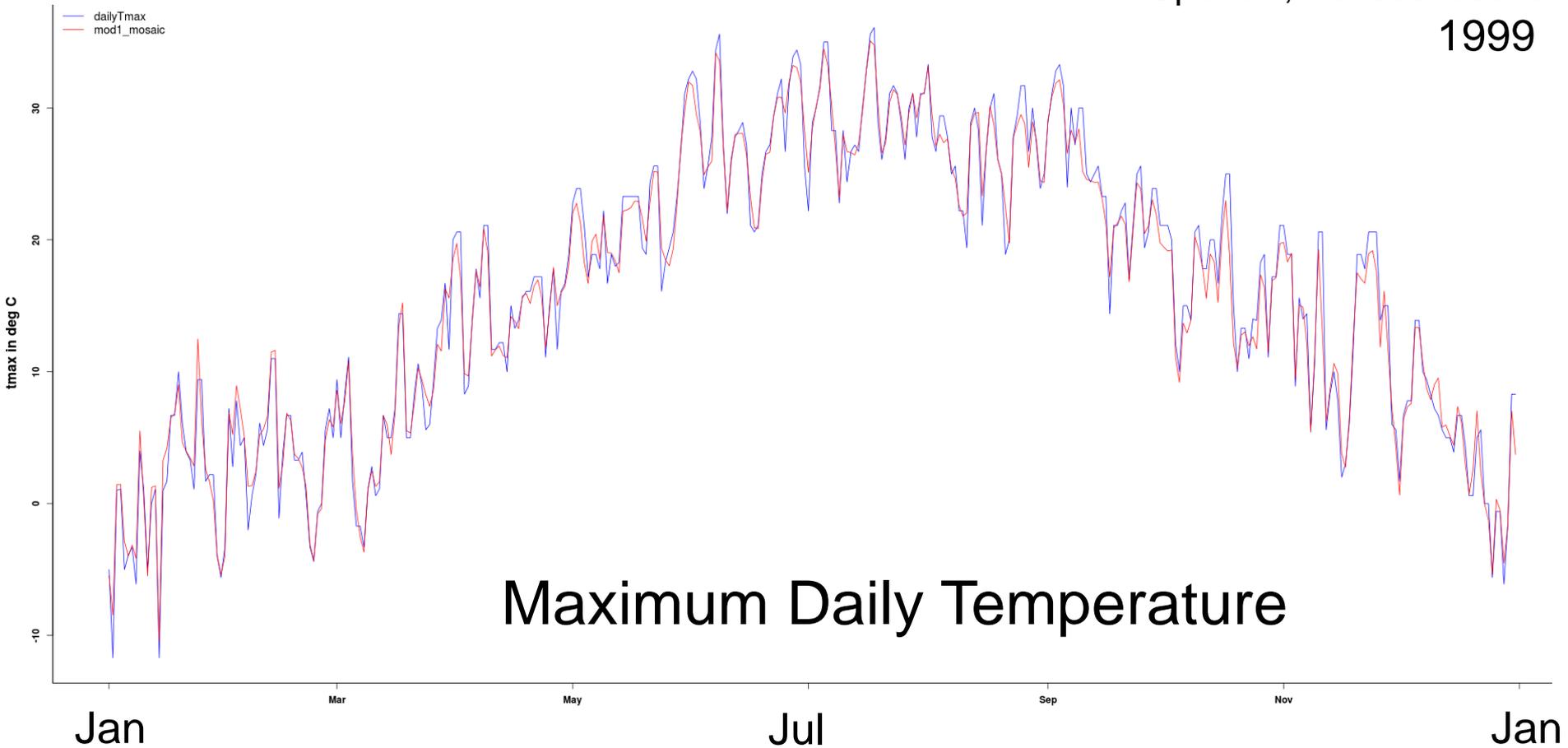


Technically, computationally comparable to MEaSURES projects

Daily, 1km temperature

Observed vs. EarthEnv Predicted

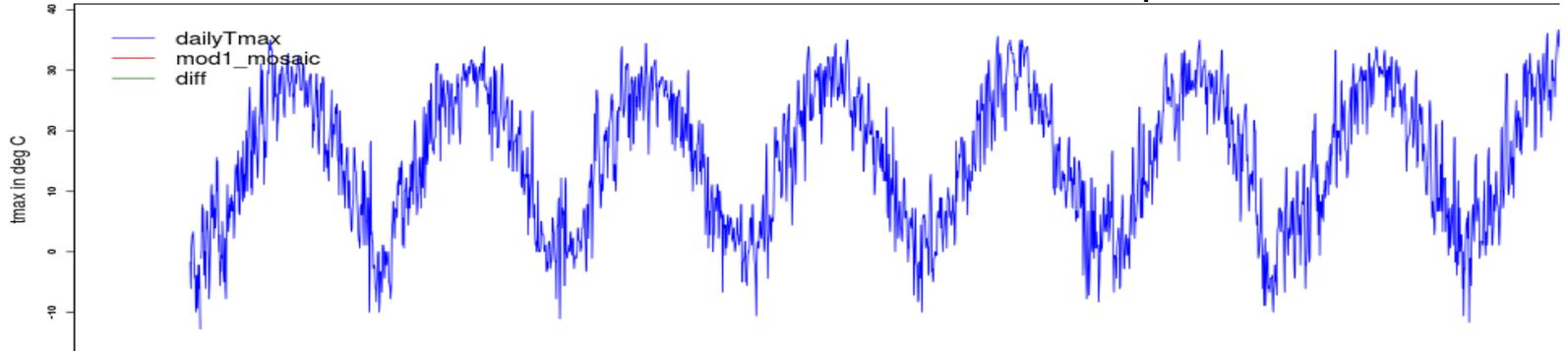
Spencer, Massachusetts
1999



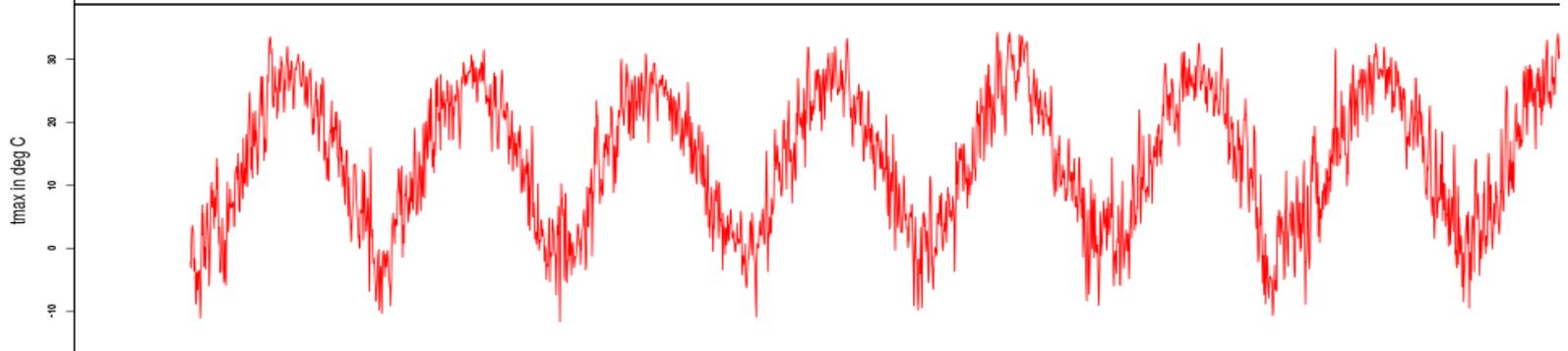
Daily, 1km temperature

Spencer, Massachusetts

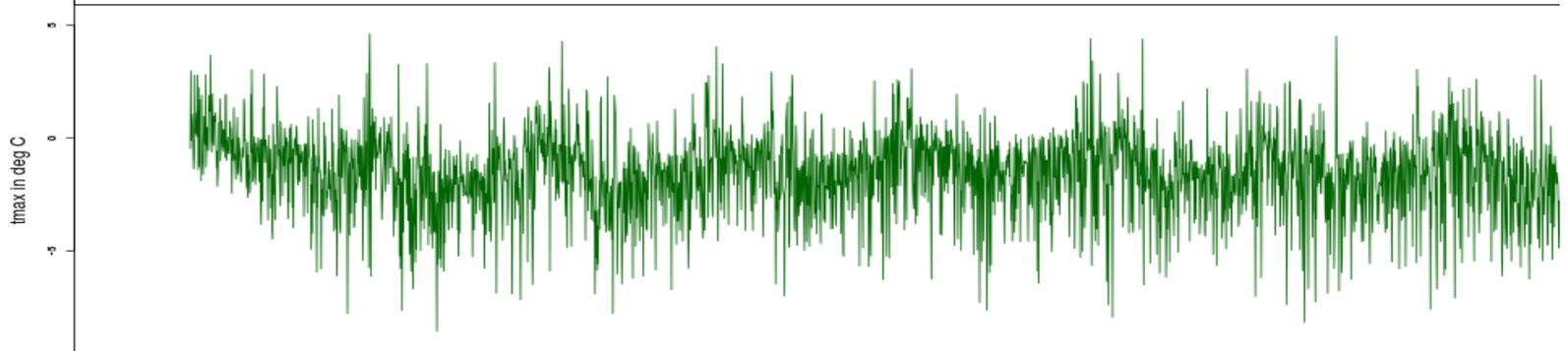
Station



1km
EarthEnv



Delta



1985

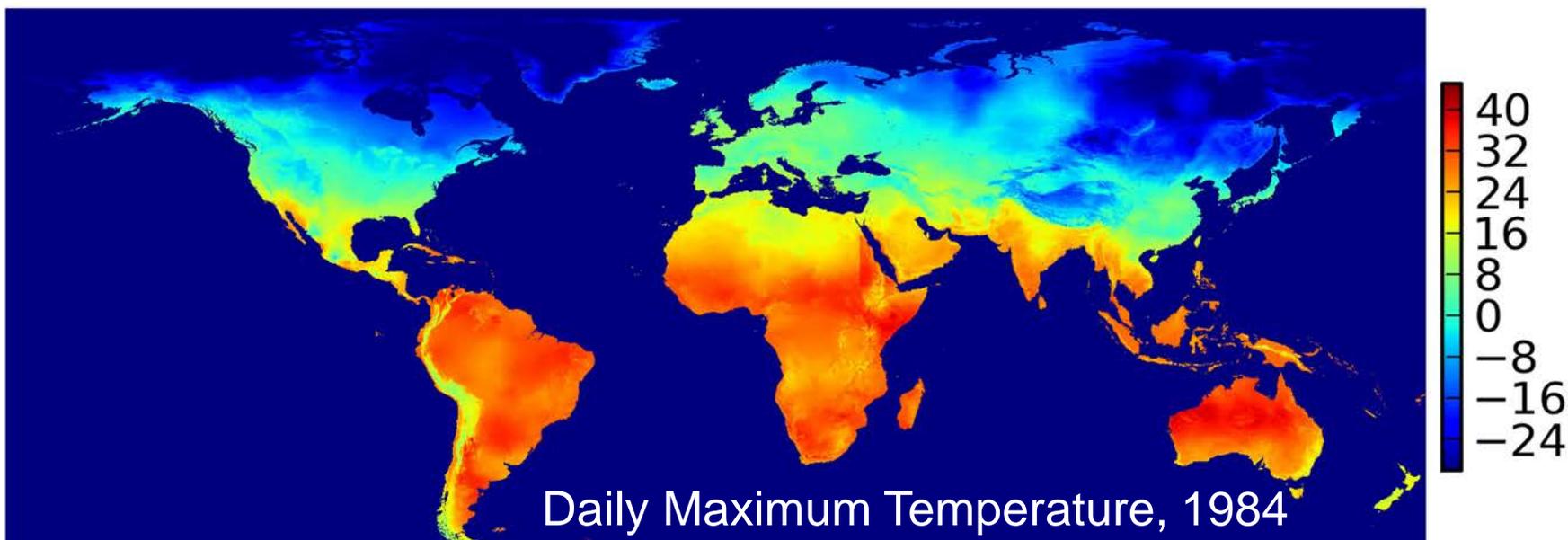
1990

Minimum Daily Temperature

Daily, 1km temperature

- MODIS cloud mask and LST data + met station data
- Max., Min. Daily Ambient Temperature 1984 – 2015
- RMSE: $\sim 2.5^{\circ}\text{C}$

19840101



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II. Develop informatics tools

MOL
MAP OF LIFE

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Putting biodiversity on the map

279 Datasets
844,971 Species
555,744,036 Records

} One Searchable Map

South Africa, Kenya, Madagascar, Mozambique

Map species
Views species range map, inventory, and occurrence data

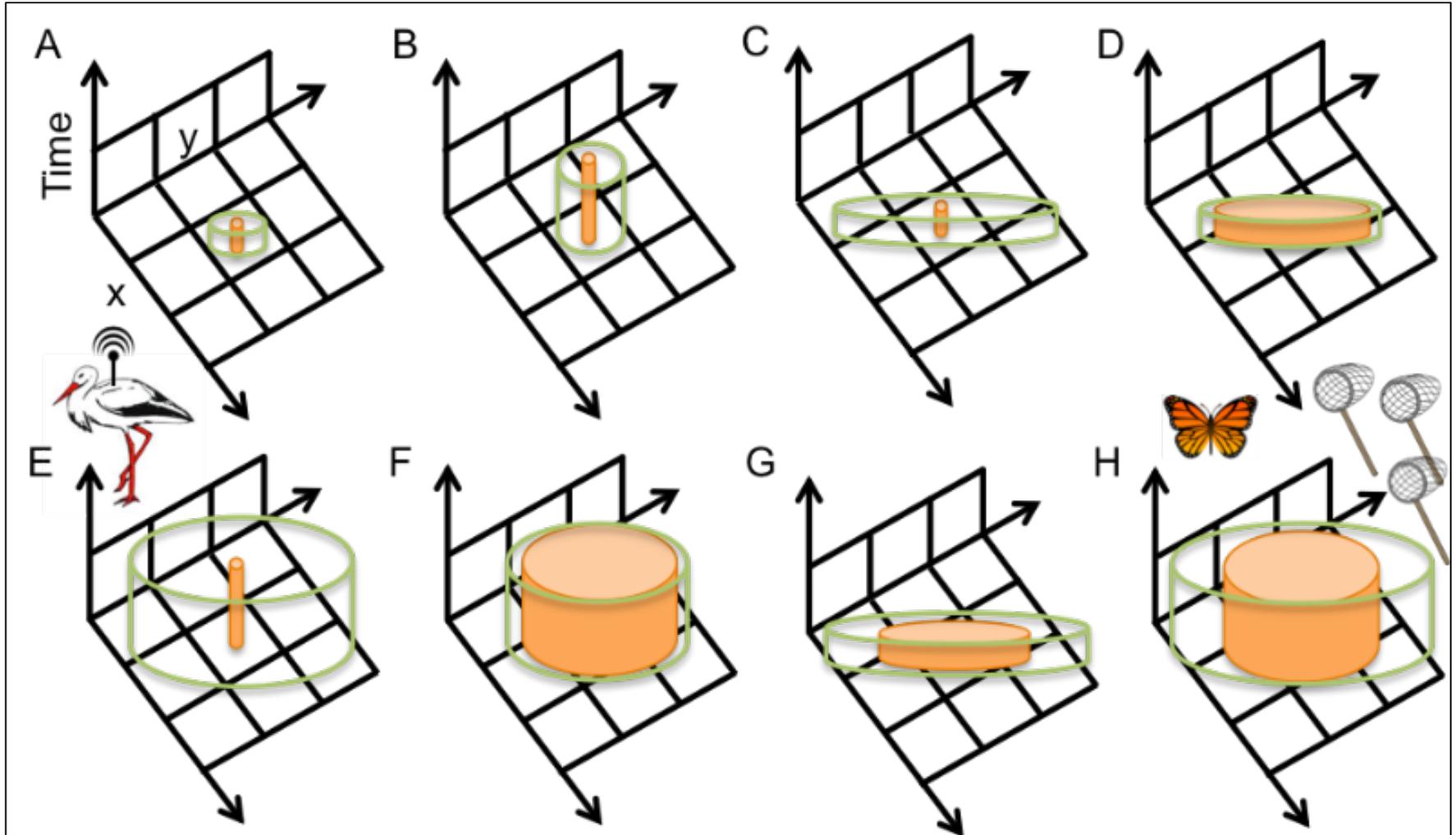
Species by location
Select a location, filter by distance or group, and view a list of species along with source data

Indicators
Explore trends in biodiversity knowledge, distribution, and conservation

Mobile App
Discover, identify, and record biodiversity worldwide

Biodiversity data \cap Environmental data

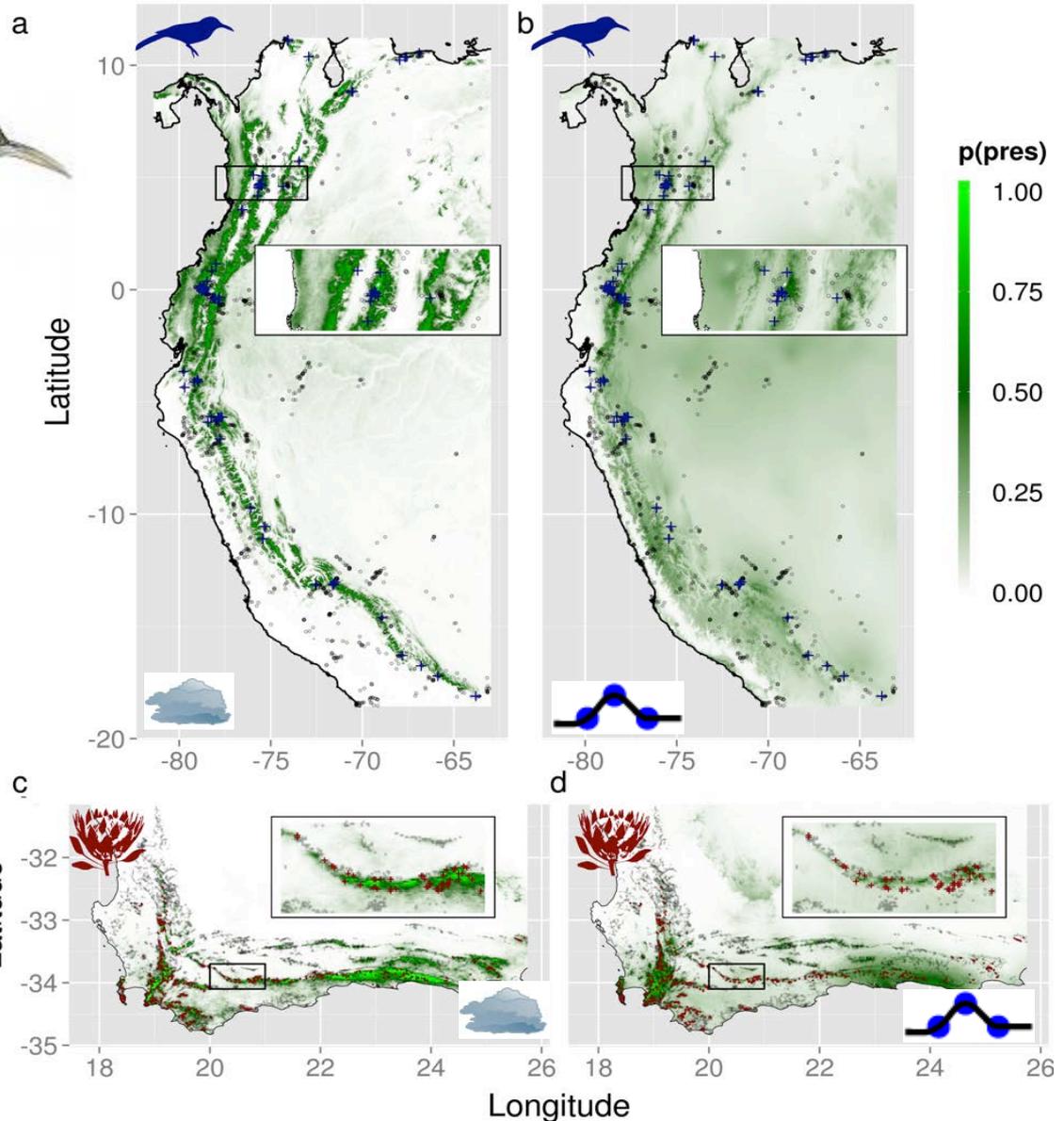
Not trivial ...



Species range predictions



Species	Data	AUC
		0.87
		0.68
		0.87
		0.82



III. Begin to support global monitoring



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Species

Locations

Indicators

Trends in biodiversity knowledge, distribution, and conservation



Species Data Coverage

View spatial and temporal gaps in biodiversity data

Explore



Species Habitat

Explore species habitat suitability

Explore Preview



Species Protection

Explore species reserve gaps

Explore Preview



Yale Center for
Biodiversity and
Global Change

Thanks ...!



Yale

Launching this fall:

Max Planck – Yale Center
for Biodiversity Movement
and Global Change

